r_i	−.2073	−1.3264	−.6079	.1954	3.2181	−.6844
N_i	1	1.6162	1	1.5725	1	1.6162
d_i	.0403	.01685	.0096	.1387	.0313	

Entrance pupil position $p = .1134$.

References

[1] Buchdahl H. A., *Optical Aberration Coefficients* (1954), Oxford Press University.

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Janina Bartkowska *

On the Correction of Pancratic Systems

Pancratic systems are often composed of not too thick lenses. Their focal lengths and their separations result from the conditions of the stabilisation of the image and entrance pupil position. If the apertures and fields in which the variable part of the system works are not too great, these systems possess mainly the third order aberrations. For the correction of these systems the method of "main parameters" with some modifications, has proved to be useful.

The following symbols are now introduced

$S_1 \ldots\ldots S_5$ – Seidel's coefficients,

A, B – parameters of spherical aberration and coma,

P, W – main parameters determining the spherical aberration and coma, the focal length being reduced to unity, the object lying for each component in infinity, the entrance pupil in the component plane,

h, α – heights and angles of the aperture ray,

y, β – heights and angles of the principal ray,

$J = \alpha y - \beta h$ – Lagrange — Helmholtz invariant,

f – focal length of the lens components.

Among the parameters A, B and the main parameters P, W there occur approximate relationships

$$A = \frac{h^3}{f^3}P + \frac{4\alpha h^2}{f^3}W + \alpha\frac{h}{f}(5.4\alpha - \alpha')$$

$$B = \frac{h^2}{f^2}W + \frac{2.7\alpha h}{f}.$$

These relationships are valid with sufficient accuracy if the magnifications of several components are less than the unity. For magnifying components these formulae lose their usefulness, since their accuracy deteriorates. In these cases one can introduce "reversed" parameters $\overleftarrow{P}$ and $\overleftarrow{W}$, determining the spherical aberration and coma, the image lying for each component in infinity. Among the parameters A and B and the reversed parameters $\overleftarrow{P}$ and $\overleftarrow{W}$ there occur approximate relationships

$$A = \frac{h^3}{f^3}\overleftarrow{P} - 4\alpha'\frac{h^2}{f^2}\overleftarrow{W} + \alpha'\frac{h}{f}(5.4\alpha' - \alpha)$$

$$B = -\frac{h^2}{f^2}\overleftarrow{W} + 2.7\frac{\alpha' h}{f}.$$

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For third order aberrations of the whole system one can obtain the following relations

$$S_1 = \sum \frac{h^4}{f^3} P + \sum 4 \frac{\alpha h^3}{f^2} W + \sum \frac{\alpha h^2}{f} (5.4\alpha - \alpha'),$$

$$S_2 = \sum \frac{yh^3}{f^3} P + \sum \frac{h^2}{f^2} (4\alpha y - J) W +$$

$$+ \sum \frac{\alpha h}{f} (2.7\alpha y + 2.7\beta h - \alpha' y),$$

$$S_3 = \sum \frac{y^2 h^2}{f^3} P + \sum \frac{2hy}{f^2} (\alpha y - \beta h) W +$$

$$+ \frac{\alpha y}{f} (5.4\beta h - y\alpha') + J^2 \sum \frac{1}{f},$$

$$S_5 = \sum \frac{y^3 h}{f^3} P + \sum \frac{y^2}{f^2} (4\alpha y - 3J) W +$$

$$+ \frac{y}{f} \left(3.7 h\beta^2 + 0.7\alpha\beta y - \frac{\alpha y^2}{f}\right).$$

Similarly when using the reversed parameters we obtain

$$S_1 = \sum \frac{h^4}{f^3} \overset{\leftarrow}{P} - 4 \sum \frac{\alpha' h^3}{f^2} \overset{\leftarrow}{W} + \sum \frac{\alpha h^2}{f} (5.4\alpha - \alpha'),$$

$$S_2 = \sum \frac{yh^3}{f^3} \overset{\leftarrow}{P} + \sum \frac{h^2}{f^2} (-4\alpha' y - J) \overset{\leftarrow}{W} + \sum \frac{h\alpha'}{f} \times$$

$$\times (2.7\alpha' y + 2.7\beta' h - y\alpha),$$

$$S_3 = \sum \frac{y^2 h^2}{f^3} \overset{\leftarrow}{P} - \sum \frac{2yh}{f^2} (y\alpha' + h\beta') \overset{\leftarrow}{W} + \frac{\alpha' y}{f} \times$$

$$\times (5.4 h\beta' - y\alpha) + \sum \frac{J^2}{f},$$

$$S_5 = \sum \frac{y^3 h}{f^3} \overset{\leftarrow}{P} + \sum \frac{y^2}{f^2} (-4\alpha' y + 3J) \overset{\leftarrow}{W} + \sum \frac{y}{f} \times$$

$$\times \left(3.7 h\beta'^2 + 0.7\alpha'\beta' y + \frac{y^2 \alpha'}{f}\right).$$

These formulae are convenient for automised computations and for the correction of pancratic systems. Finally taking into account some possible positions of lenses, we get a system of linear equations. For that purpose suitable programs were prepared, to calculate the coefficients of the equations and to solve the equations by the method of the least squares. The tables [1, 2] facilitate the choice of glasses and the calculations of curvatures if several components are double-cemented lenses.

Pancratic systems thus computed needed only small correction with ray tracing.

References

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A Single-Lens Stigmatic Condensor

1. Single-lens condensors are employed in the laser devices (see [1—3]). The purpose is to achieve a perfect focussing of the parallel monochromatic light beam. The condensor presented in the paper is of the convexo-concave type, the convex surface being aspherical. The condensor happens to fulfil all the conditions requested for such a system of the *f*-number equal to 1 and a perfect correction achieved for a parallel light beam of λ = 1.06 μm.

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